



**Pennsylvania's  
Commonwealth Public Safety Broadband Network (CPSBN)**

October 2017



## Who Is Rivada?

Rivada is an innovator in Public Safety broadband communications and wholesale mobile-data markets

**Specializing in Public Safety communications, Rivada will deliver a purpose-built Public Safety network that ensures financial sustainability of the CPSBN.**

### Experience

Veteran team of global industry leaders and innovators with significant wireless, wholesale and Public Safety experience

### Purpose Built

Purpose-built unified communications platform serving all Public Safety and driving innovation

### FirstNet Knowledge

Since 2006, Rivada Networks has been heavily involved in making the NPSBN a reality for Public Safety

### Open Market and eLBS IP

Innovative and revolutionary portfolio with over 300 patents covering wireless markets and enhanced-location services

## Opportunity: Rivada Will Build an Unprecedented Network in Pennsylvania

- Only network focused on Public Safety and only dedicated wholesale network in the Commonwealth
- Rivada will have the most extensive area and population coverage of any operator in Pennsylvania
- No legacy network and overhead = lower cost, higher performance
- Superior and best in-building coverage due to low frequency spectrum, broad deployment
- The only business model that provides sustainability over 25 years and the opportunity to reinvest in the network



## What does this mean to Pennsylvania?

### A dedicated Band 14 wireless network for Public Safety

- Pennsylvania retains an asset (spectrum) that is worth as much as \$520M.
- Extended coverage and best technology for First Responders.
- Low cost to incentivize adoption.
- Public Safety grade and resilient to disasters.
- True local control: “A Pennsylvania Network for the Commonwealth”.
- A self-sustainable business model that does not require money from Pennsylvania.

### Empowering Governor Wolf’s Initiatives

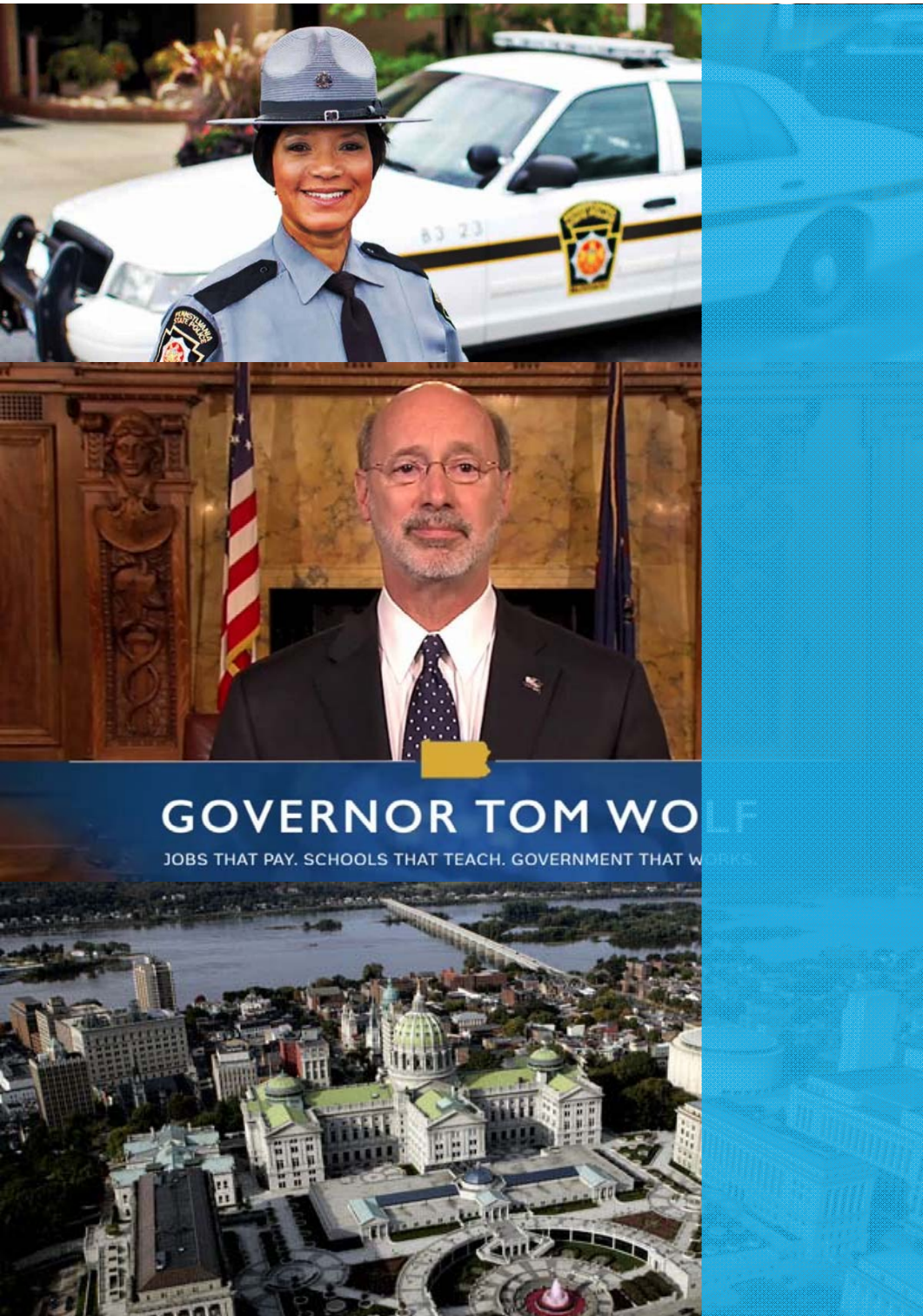
- Generation of 6,000 direct, indirect and induced jobs.
- Enhanced connectivity for public schools and educational centers.
- Bring Internet access to unserved areas of the Commonwealth, residential and small business.
- Leveraging Commonwealth-owned fiber and other assets.

### Smart Connectivity

- Pennsylvania to become the leader of the Smart Cities movement, with the potential to lead the country in technological advancement and innovation.

### More Competition > Lower Prices

- Rivada’s Neutral Carrier nature will foster more competition among wireless commercial networks, lowering prices and benefiting all Commonwealth residents.



## What Pennsylvania gains by “Opting Out”?

1. Retain 700 MHz spectrum for the benefit of all residents of the Commonwealth, and do not give a \$520M automatic gift to AT&T by opting in.
2. Build the dedicated, safety grade, purpose-built network that Public Safety in Pennsylvania deserves.
3. Exercise true Local Control. Decide who has priority/preemption. Do not let others control YOUR network.
4. Bring real savings to Public Safety at local and state level, foster competition, and exploit the network for technological advancement. The CPSBN should benefit ALL Pennsylvania.
5. No financial obligations for Pennsylvania. NO-COST Model.

**Opting Out : Nothing to lose and MUCH MORE TO GAIN**

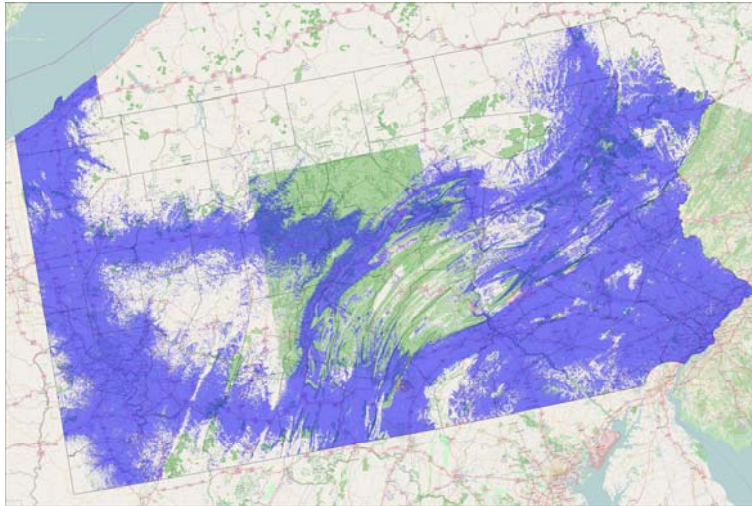


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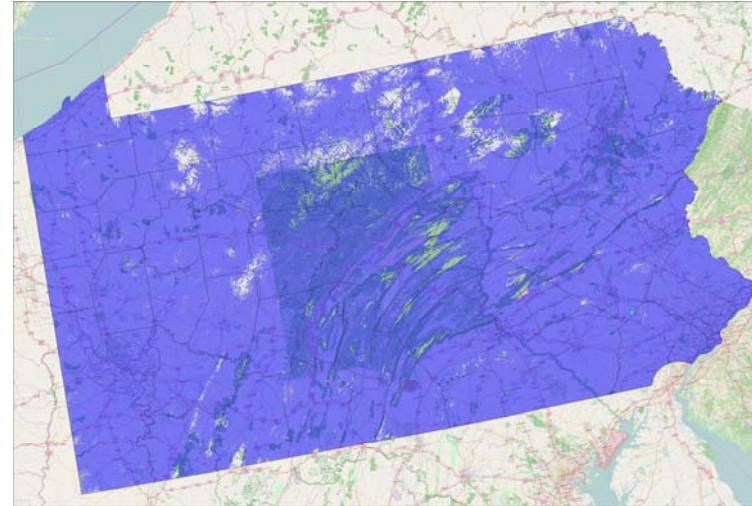
## TECHNICAL PLAN – OVERVIEW

# Deployment Schedule and Coverage

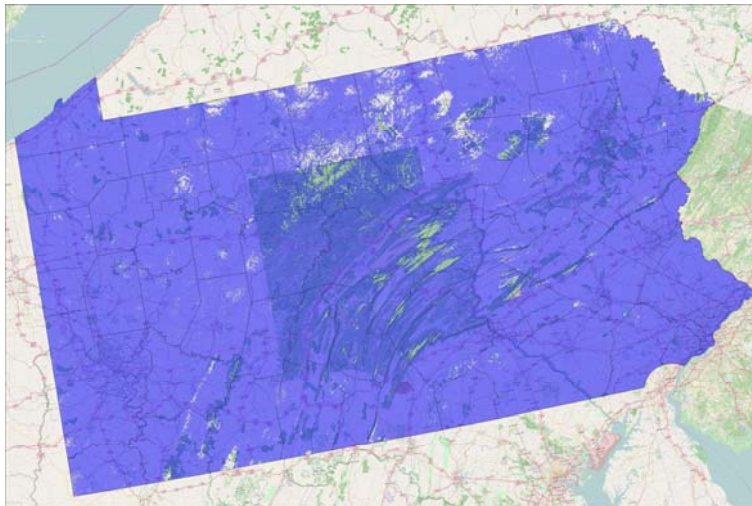
Year 1 – 85.2% Pops Coverage



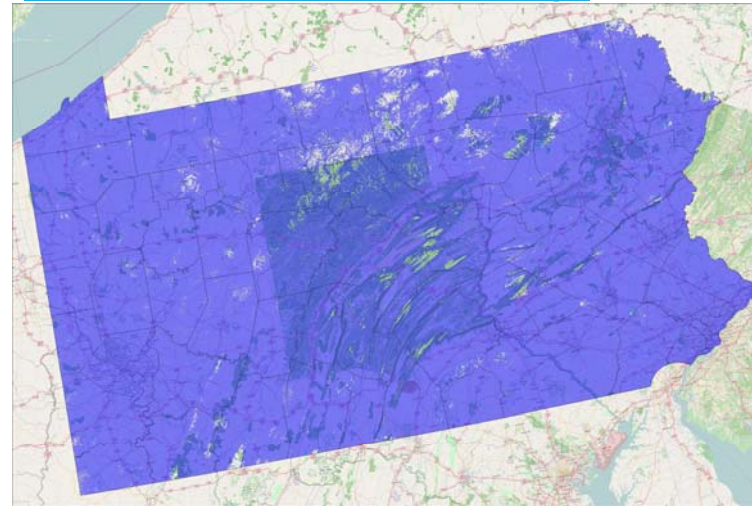
Year 2 – 99.1% Pops Coverage



Year 3 – 99.3% Pops Coverage



Year 4 – 99.5% Pops Coverage



Rivada will offer the BEST LTE Coverage:  
**Area Coverage: 94.6%**  
**Pops Coverage: 99.5%**

**Rivada's Band 14 coverage footprint provides:**

- Better than commercial coverage
- Ruthless Preemption for public safety
- Priority Access for public safety
- Mission Critical Services for public safety

## Cost

Build CAPEX (4 years): ~\$342M

CAPEX (25 years): ~\$1.6B

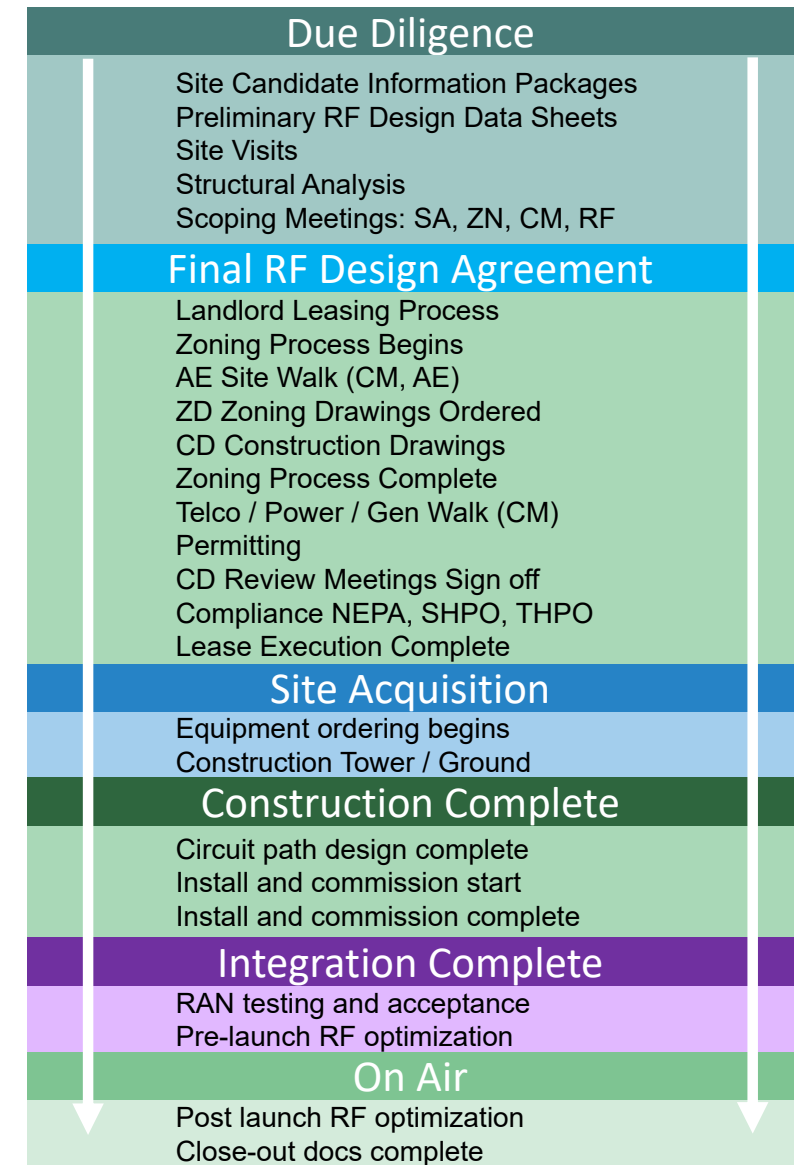


**Coverage Sites**  
**1,284**



# Buildout Timeline and Methodology

- 4 teams of SME's deploying 440 sites over 3 yrs
- Borrowing from proven methodologies and tools used accelerate New LTE deployments across the US
- Follows same systematic approach across the Commonwealth
- High Transparency
- Leveraging Local Certified Contractors
- Site by Site Focus – daily updates
- Speed to Market - without compromising network design or capabilities
- Utilizing existing commercial and government assets when available
- Leasing infrastructure and transport capacity when practical and reliable
- Dynamic – senior team members ability to take corrective action in the field incl. automated reporting





# Comparability to AT&T's approach

	Rivada Approach	AT&T Approach
<b>Coverage</b>	<b>Better Rural Coverage. All coverage on band-14 Public Safety Spectrum.</b>	Leveraging their existing network footprint across multiple frequency bands.
<b>Interoperability</b>	<b>Uses proven tier-1 LTE infrastructure that is 3GPP standards compliant and inherently interoperable. We use the same vendors that AT&amp;T uses to ensure interoperability with FirstNet.</b>	The best way to ensure interoperability across the nation is using the same frequency band across the entire network. AT&T is not planning to build a state-wide Band 14 network.
<b>Priority &amp; Preemption</b>	<b>Only Rivada can guarantee <b>Ruthless Preemption</b> and true <b>Tiered Priority Access</b>, because we invented the technologies. They are fully 3GPP compliant and interoperable with LTE.</b>	AT&T leverages generic infrastructure vendor supplied features for very basic Priority and Preemption.
<b>Applications</b>	<b>The legislation only requires States to be responsible for their Radio Access Network (RAN). Rivada suggests that Pennsylvania use the FirstNet application ecosystem.</b>	AT&T is required to establish a public safety application store front as part of the FirstNet requirement. It is expected that more than 99% of FirstNet applications will be from 3 <sup>rd</sup> parties.
<b>Access to Commercial Bands</b>	<b>CPSBN users will have coverage from the Sprint network whenever Band-14 is unavailable as a temporary or fallback solution.</b>	AT&T provides access to non-public safety bands, on their commercial network, that do not have the same licensing benefits of LTE band-14. Commercial spectrum limits both network performance and interoperability with other States.
<b>Local Control</b>	<b>True Local Control – Allowing First Responder incident commanders to have policy controls for specific groups of public safety users, with high granularity if desired.</b>	Pre-set network-wide controls available to First Responders. Public Safety has no control over specific network policies, only high level toggles.
<b>Public Safety Grade</b>	<b>Establishing a comprehensive PSG plan that address both infrastructure and operational service reliability</b>	AT&T will operate NPSBN sites at the same grade as their commercial network.

# Integration with FirstNet Core

<b>Compliant with FCC Requirements</b>	The CPSBN is fully compliant with the standards defined by law and presented in the FirstNet RFP, also known as the Required Minimum Technical Requirements (RMTR) and recently reaffirmed by the FCC.
<b>Seamless Service</b>	Seamless service between the networks is ensured by using the same standards that are used by operators to ensure interoperability across the world every day and that AT&T uses. Any incompatibility is manufactured by AT&T to raise false concerns. Verizon’s public remarks validate this statement.
<b>Unified Security Standards</b>	The foundational security layers of the network are defined in the LTE standards and are completely compatible between the networks. In addition, Rivada’s “defense in depth” security strategy is consistent with industry standards. Rivada fully supports any information exchange that will enhance security between the networks.
<b>Applications</b>	Rivada will host the same application services as FirstNet in the event that AT&T continues to deny access to their application servers by opt-out states. This approach will allow Pennsylvania to determine and control the deployment of applications according to the needs of Pennsylvania’s public safety users.
<b>Quality of Service and Priority and Preemption (QPP)</b>	The Rivada implementation of the CPSBN allows local public safety entities to set and control the QPP settings for their first responders. The local incident commanders will need this control in the event of an emergency. Basic QPP parameters can be passed through through to the AT&T/FirstNet network in much the same way as subscriber plan information is passed between networks to enable roaming.
<b>Local Control</b>	Rivada gives Pennsylvania First Responders the ability to manage the user experience and priority levels for visiting first responders to ensure that, during an emergency, both visiting and local first responders can work together seamlessly as a team with the appropriate priority and access levels.



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## FINANCIAL PLAN – OVERVIEW

# Sustainable Financial Model

## Public Safety

- Free Voice and Text, low-priced Data plans, one unlimited plan and one pooled plan, including \$0.01 access fee and 2GB Free for Primary First Responders<sup>1</sup>
- Preferential Pricing Plans for Extended Primary Users

(1) Primary First Responders defined as Police, Fire, and EMS – Certain limitations apply.

## Self-Sustainable Network + Financing


- Excess Capacity Monetization of the Network
- Financing:
  - Project will need about \$418MM
  - About 36% of total funding covered by NTIA Grant (\$149M)
  - Remaining balance to be facilitated by Rivada and supported by wireless equipment providers and top financial institutions:

Morgan Stanley



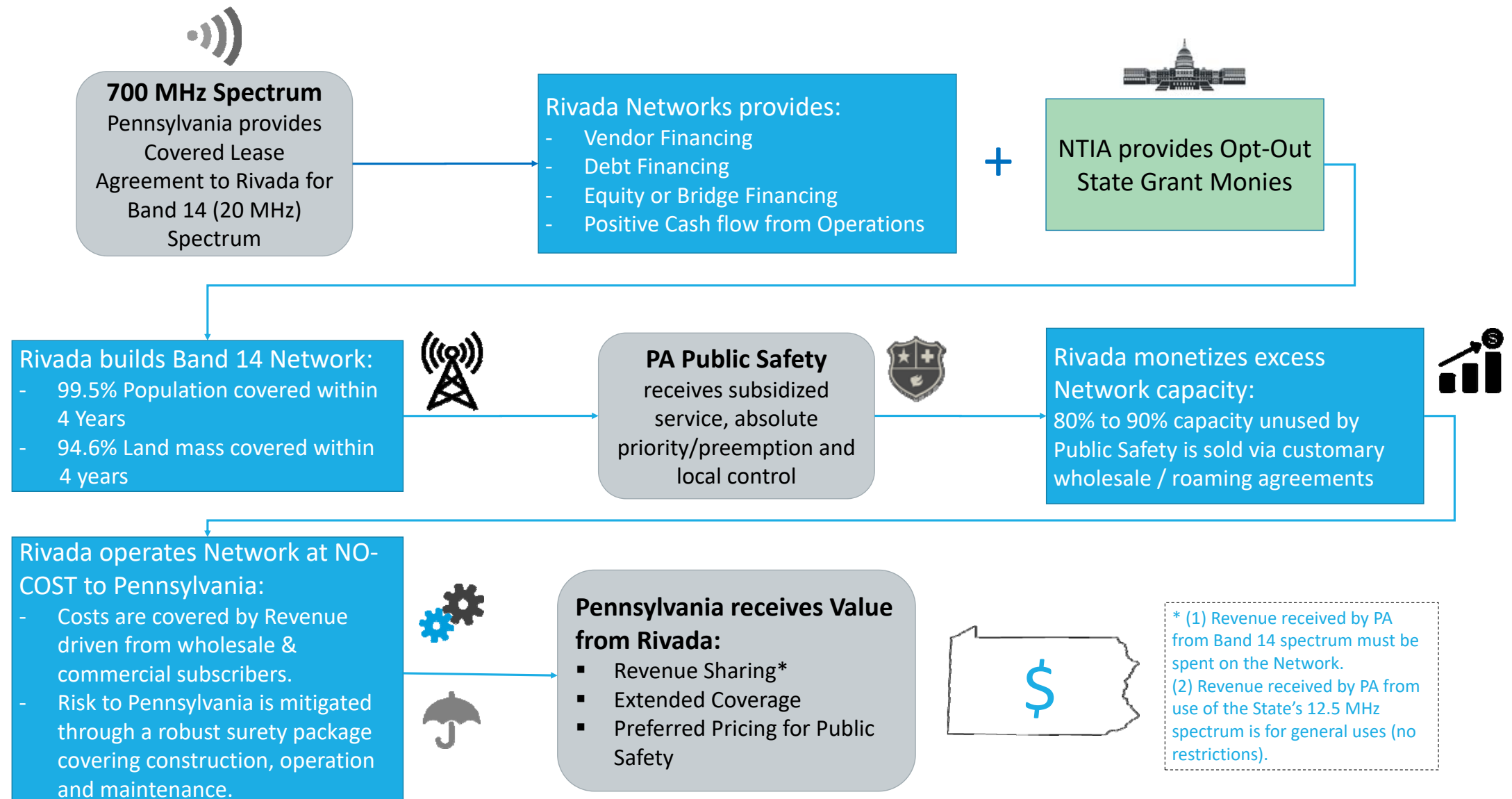
Deutsche Bank

KKR



Rivada will make  
the Public Safety  
Network a reality  
for Pennsylvania

# Rivada's Business Model



## Expected Value to Pennsylvania

**Expected Cash Value – 3% Revenue Sharing with State** **\$382MM**

- Potential uses by Pennsylvania:
  - Increase rural coverage overtime
  - Cover cost of communication services: State budget savings
  - Allocate funding to support local Public Safety communications programs

**Expected Cash Value – Payments to FirstNet and Taxes** **\$580MM**

- Payments to or on-behalf-of the State of Pennsylvania:
  - Spectrum Leasing Fees
  - FirstNet Core Payments
  - App Ecosystem Payments
- State Taxes


**In-Kind Value (Preferential Pricing Plans – Public Safety)** **\$1,142MM**

**Total Expected Value Pennsylvania (25 years): \$2,104MM**








**JOBS ~6,000 Direct, Indirect and Induced Jobs**


# User Data Plans: Public Safety



ONE




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-  \$0.01 Monthly Service charge
-  \$/GB charge for usage beyond 2G
-  Unlimited Talk and Text
-  First 2GB of Data Included Per Month, on Pooled Basis
-  Includes Hotspot Capability, Quality of Service, Priority and Pre-emption (QPP)



\$ 20 UNLIMITED

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-  Unlimited Talk and Text
-  Unlimited High Speed Data<sup>1</sup>
-  Includes Hotspot Capability, Quality of Service, Priority and Pre-emption (QPP)<sup>1</sup>

- Simple Rate Structure
- Low entry barriers to overcome price sensitive thresholds
- Priority and Preemption at no cost for Primary First Responders
- Rivada to guarantee offer for 5 Years

(1) Notes:

- Data speeds may be temporarily slower at times of network congestion in a non-emergency scenario.
- Under no circumstance will Rivada slow down speeds when the network is congested in the event of an emergency.
- Rivada will offer a separate service whereby data speeds are guaranteed not to be slowed down in times of network congestion in an a non-emergency situation. As part of this service, any incremental usage above the monthly data allowance or hotspot allowance will be charged at the prevailing rate with expected market rates per GB/month, e.g., 2018 pricing of \$8.26/GB, 2019 pricing of \$6.21/GB, 2020 pricing of \$4.85/GB. No throttling.

## Financing / Bonding

### Financing

- Requirements: **\$418M**
- Combination of:
  - NTIA Grant - **\$149M** (It is \$160M in Proposal)
  - Vendor Financing - **\$77M**
  - Debt / Equity (including 20% matching federal grants) - **\$192M** (It is \$181M in Proposal)
  - Positive Cash Flows from Operations > Capex Maintenance

### Bonding Package

- Completion and Ongoing Operational Risk Mitigation:
  - Performance and Payment Bonds
  - Financial Guarantee Bond
  - Annual Concessionaire Bond (Operation and Maintenance)

## No-COST and Low-RISK plan for Pennsylvania

Notes:

- Performance and Payment Bonds will remain in place throughout the entire construction period and will not be retired as and when coverage targets are met.
- Under no circumstance will Rivada slow down speeds when the network is congested in the event of an emergency.
- Rivada will offer a separate service whereby data speeds are guaranteed not to be slowed down in times of network congestion in a non-emergency situation. As part of this service, any incremental usage above the monthly data allowance or hotspot allowance will be charged at the prevailing rate. No throttling.

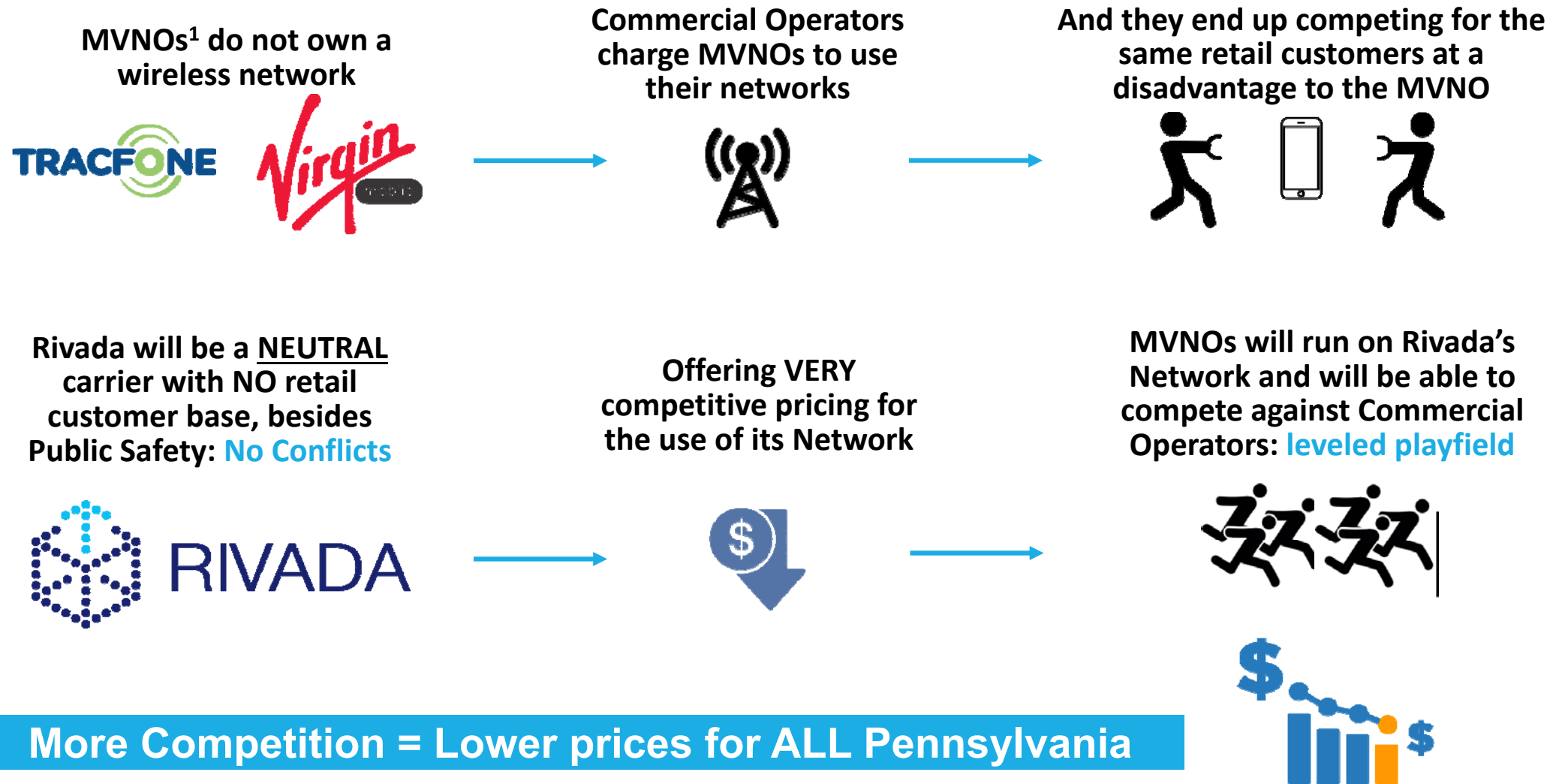




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APPENDIX

# How Wholesale Networks Work



(1) MVNO = Mobile Virtual Network Operator

# Achieving Revenue Objectives

## Wholesale

- Wholesale-only provider eliminates the conflict of interest in the carrier retail / wholesale market
- Wholesale creates attractive neutral network with transparent, non-discriminatory pricing to MVNOs

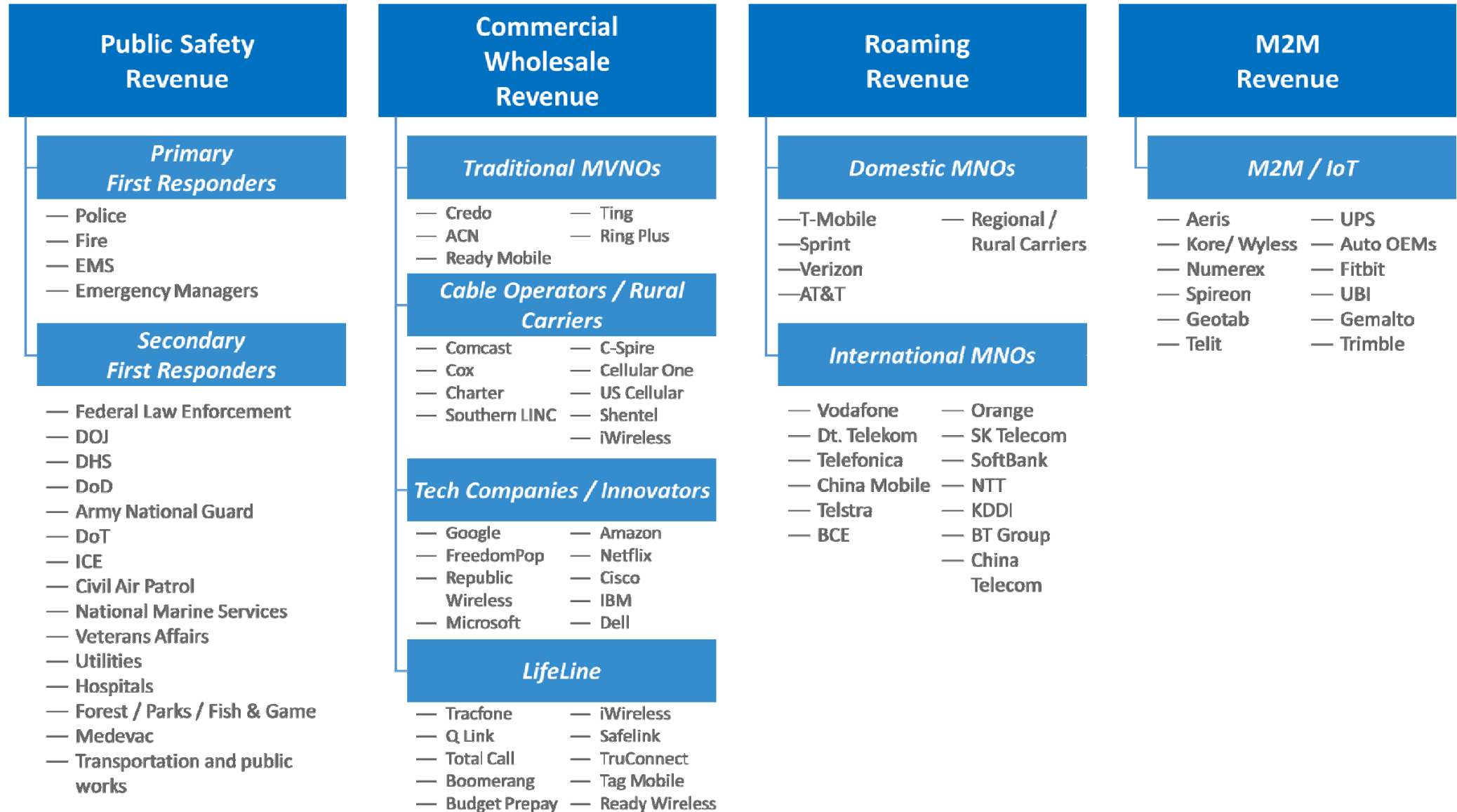
## Roaming

- Best network coverage will drive demand

## Extended Primary Users

- Best coverage and economics will drive volume

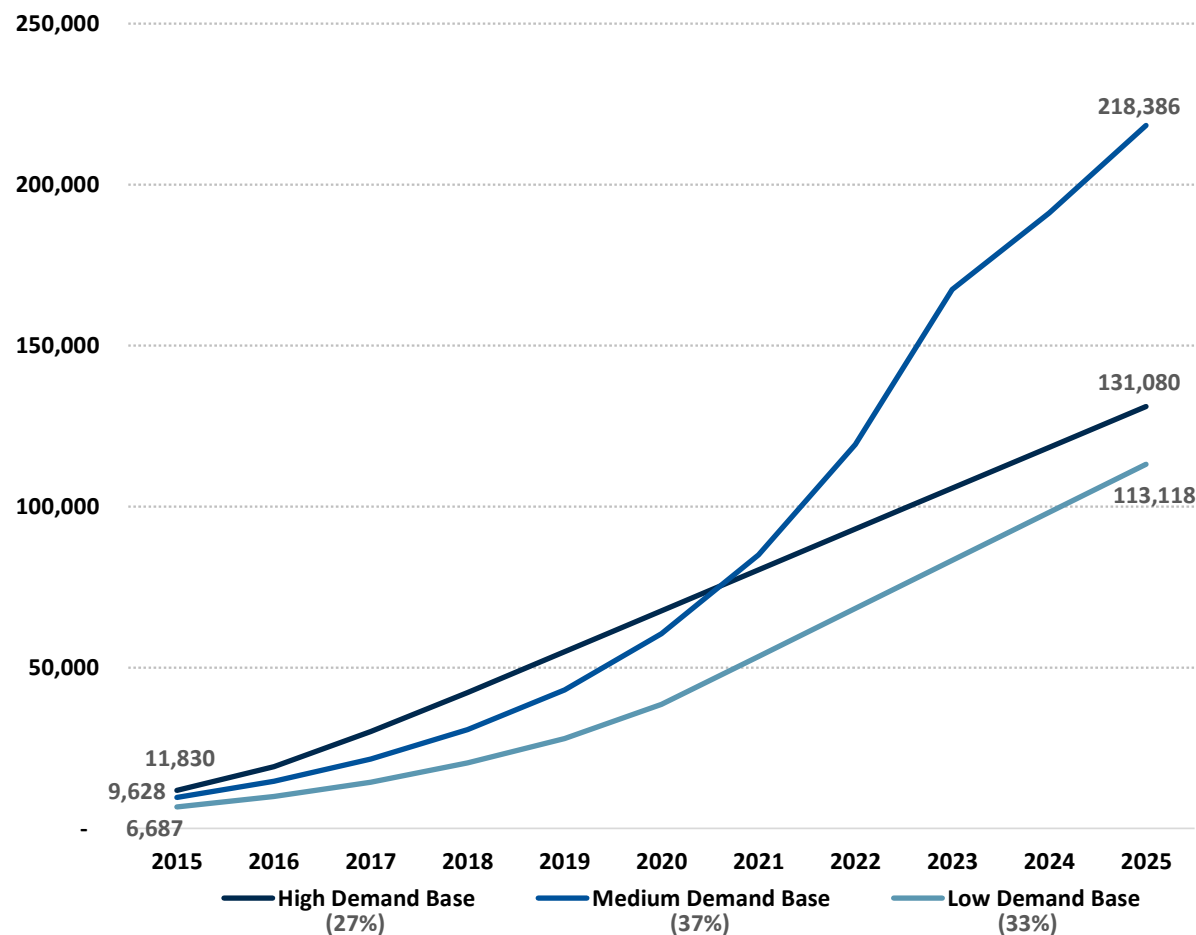
# Revenue Streams and Potential Customers



# Data Demand - Wireless

Wireless data growth in the U.S. has been explosive since 2011: using a conservative estimate, the wireless demand will grow from 20,402 PB/year in 2018 to over 113,000 PB/year by 2025 with a CAGR of 27%

**Wireless Demand (2015-2025) PB/Year; 7-year CAGR**



### Implications

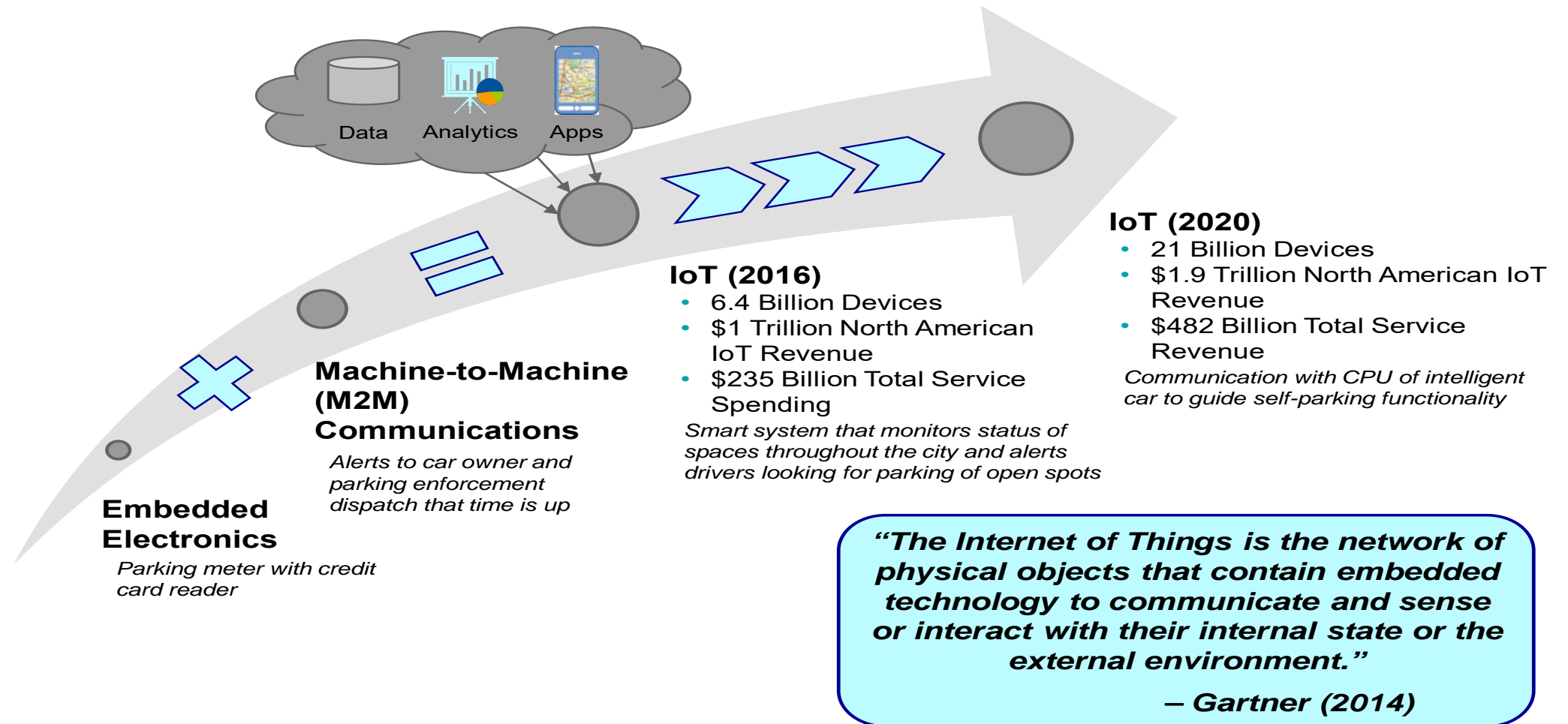
- The long build out of wireless infrastructure means stop-gap measures may be required in the interim to support mobile traffic growth in certain areas and times
  - Technological improvements may not be sufficient to address the growth demand
  - FirstNet add provides additional capacity for innovation and economic growth
- The medium demand base case has a higher CAGR beginning in 2020, driving its uptick

### Key Growth Drivers

	Devices	Uses
Human	<ul style="list-style-type: none"> <li>▪ Smartphones</li> <li>▪ Phablets</li> <li>▪ Tablets</li> <li>▪ Gaming devices</li> <li>▪ Cellular modems</li> <li>▪ Etc....</li> </ul>	<ul style="list-style-type: none"> <li>▪ Mobile gaming</li> <li>▪ Video</li> <li>▪ MMS/SMS</li> <li>▪ Email/Web</li> <li>▪ Music/OTTs</li> <li>▪ Etc....</li> </ul>
Non-Human	<ul style="list-style-type: none"> <li>▪ Vertical-specific IoT</li> <li>▪ M2M communications</li> <li>▪ Connected cars</li> <li>▪ Sensors</li> <li>▪ Smart machines</li> <li>▪ Etc....</li> </ul>	<ul style="list-style-type: none"> <li>▪ Optimization</li> <li>▪ Sensing</li> <li>▪ Communication</li> <li>▪ Health and Safety</li> <li>▪ Operations</li> <li>▪ Etc....</li> </ul>

# Internet of Things (IoT / M2M)










Gartner forecasts 21B IoT devices and IoT \$482B in service revenue by 2020



# Rivada Business Model



Our business model is based on being the premier public safety and wholesale service provider.

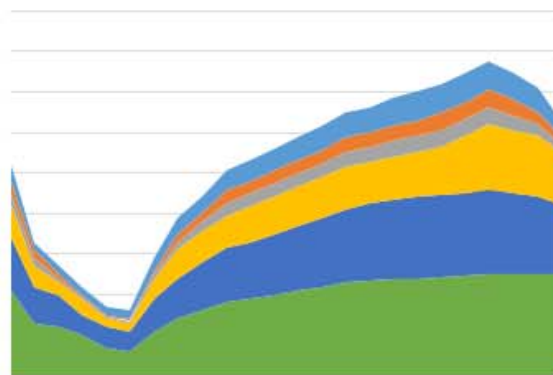
<p><b>Public Safety Focus</b></p> <hr/> <p>Purpose built unified communication platform serving all Public Safety and driving innovation</p>	 <p><b>Public Safety</b> First responders need access to real-time mission-critical connectivity and data services</p>	 <p><b>Best-in-Class Technology</b> LTE Technology that offers the best coverage and performance because it matters</p>	 <p><b>Preferential Pricing</b> A service that Public Safety can massively adopt due to very attractive rate plans</p>
<p><b>Wholesale</b></p> <hr/> <p>Rivada's business model turns networks into markets</p>	 <p><b>Roaming</b> Demand for network roaming from other carriers will drive revenue</p>	 <p><b>Wholesale</b> MVNO's desire a neutral wholesale-only network provider</p>	 <p><b>Machine-to-Machine</b> M2M providers need on demand connectivity in the right place at the right time</p>
<p><b>Neutral &amp; Trusted Partner</b></p> <hr/> <p>Rivada is a truly neutral provider of wireless capacity</p>	 <p><b>No conflicts</b> As a wholesale operator Rivada is not conflicted and supports all providers</p>	 <p><b>Low Cost</b> Focused on delivering advanced connectivity at the lowest cost per bit</p>	 <p>Efficient use of all spectrum resources available</p>

# Dynamic Spectrum Arbitrage and Open Access

With Rivada’s Open Access technology, capacity can be purchased in any combination of time, location and priority – driving the ability to monetize excess capacity of all carriers



Segmentation  
by Time of Day



Network capacity can be sliced by time of day for auction to buyers



Segmentation  
by Location



Network capacity can be sliced by location for auction to buyers



Traffic  
Prioritization



Traffic can be easily re-prioritized and users can be switched seamlessly to other systems in milliseconds



## Enhanced Location Based Solution (eLBS)

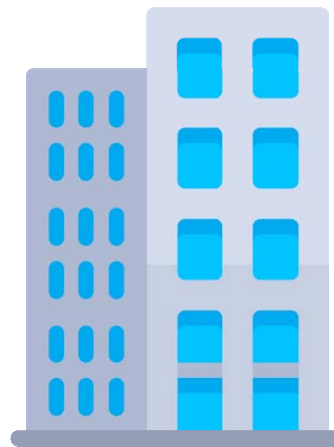
Rivada's eLBS offers distinct differentiation compared to current location based service solutions – driving the ability to monetize this solution

### Indoor and Underground



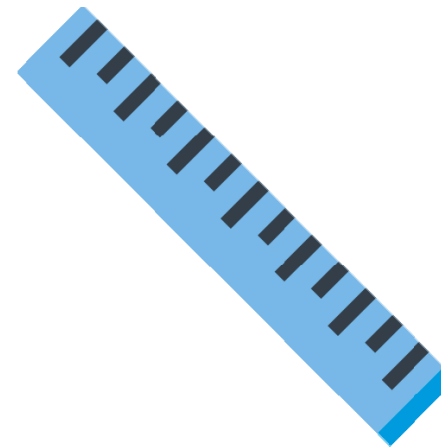
Rivada's can deliver indoor and underground location.

### Outdoor Urban and Obstructed



In urban areas with restricted view of the sky, Rivada can improve location accuracy.

### Enhanced Location Accuracy



Even in areas with a clear view of the sky, Rivada can deliver enhanced accuracy.

### Jamming and Interference Resistant



When GPS signals are not available, Rivada can use multiple inputs to distribute location information on a peer to peer basis.

# Patent Portfolio

Innovative and revolutionary portfolio with over 300 valuable and relevant patents developed over past 10 years

## Number of Patents Filed

**313**

Provisional 21

Filed, not granted  
**185**

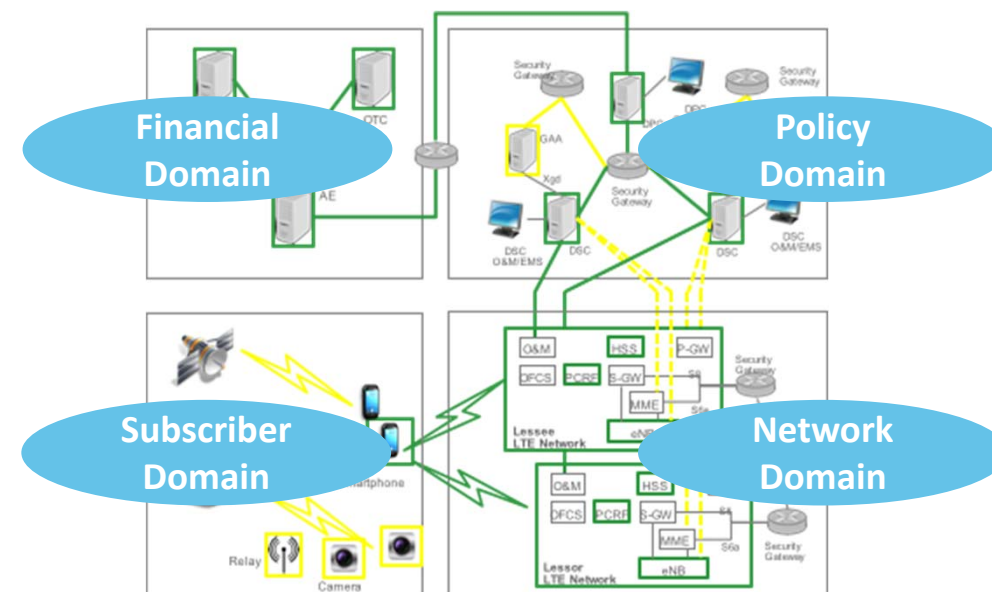
Granted / Allowed  
**107**

As of Q317

## Opportunities to Monetize Portfolio

- Further developing IPR
- Developing products and apps
- Pursuing partnerships and licensing deals
- IPR: Open Access Wireless Market and enhanced Location Based Services (e-LBS)

## Communication Value Chain by IP Domain



# Rivada's Board of Directors



Rivada's board has a powerful mix of seasoned public safety experts and communications investors



**Declan J. Ganley, Founder, Chairman and CEO of Rivada Networks**

Ganley is primarily a telecommunications entrepreneur, having built businesses across Europe, Russia, and the United States. Representing Rivada Networks, Declan received the Louisiana National Guard Distinguished Civilian Service Medal for his work during Hurricane Katrina.



**Martin O'Malley, Former Governor of Maryland**

O'Malley served two terms as Governor of Maryland from 2007-2015. Prior to that, he served two terms as Mayor of Baltimore. He co-chaired the National Governors Association's Task Force on Homeland Security and was the first Maryland governor to deliver interoperable radio communications for all of Maryland's first responders.



**Jeb Bush, Former Governor of Florida**

Jeb Bush was the 43rd governor of the state of Florida, serving from 1999 through 2007. Prior to and after his tenure as Governor, Bush was actively involved in the private sector helping to build the largest full service real estate company in South Florida and owning and operating successful consulting and investing businesses.



**Gabriela Lippe-Holst, CEO of Acqpart AG**

Lippe-Holst co-founded Acqpart and Acqufin, two international investment management companies, and currently serves as the Chairperson of the Board at Acqpart and CEO of Acqufin. Prior to this, Gabriela spent nearly 15 years at Swiss Re between Zurich and New York where, as a Managing Director, she held legal and risk management responsibilities that extended to Latin America.



**George Foresman, Former Under Secretary, U.S. Department of Homeland Security**

Foresman was confirmed as America's first Under Secretary of Preparedness at the Department of Homeland Security in December 2005. On March 31, 2007 he became the first Under Secretary for National Protection and Programs at DHS.



**Richard B. Myers, Former Chairman of the Joint Chiefs of Staff**

Gen. Myers became the fifteenth Chairman of the Joint Chiefs of Staff on Oct. 1, 2001. In this capacity, he served as the principal military advisor to the President, the Secretary of Defense, and the National Security Council.



**Michael P. Jackson, Former Deputy Secretary U.S. Department of Homeland Security**

Jackson served as Deputy Secretary from 2005 until 2007. In this role, Jackson served as DHS's chief operating officer, with responsibility for managing day-to-day operations.



**Don De Marino, Chairman, U.S.-Arab Chamber of Commerce**

De Marino is an international businessman and former government official. He served as Deputy Assistant Secretary of Commerce and as Director of the U.S.-Saudi Joint Economic Commission. He is presently Chairman of the National U.S.-Arab Chamber of Commerce.



**Peter Goldscheider, Managing Partner, EPIC Investment Bank**

Goldscheider has 25 years' experience as a senior executive in finance. Before jointly establishing EPIC, he was Vice President for Marketing and Sales and Member of the Board of Zürich Kosmos Insurance Company in Austria. He began his professional career with IBM Austria..



**Admiral Jim Loy, Former Deputy Secretary, U.S. Department of Homeland Security**

Admiral Loy completed a 45-year career in public service in 2005, retiring as the Deputy Secretary of Homeland Security, a position that he held from 2003 to 2005. In this capacity, he was involved in all aspects of consolidating 22 separate agencies into one unified cabinet department as well as managing the day-to-day activities of the agency.



**Former Chief of the Defence Staff UK, Field Marshal The Lord Guthrie**

Field Marshal Guthrie was Chief of the Defence Staff in the United Kingdom between 1997 and 2001 and Chief of the General Staff of the British Army between 1994 and 1997. He is a member of the House of Lords. He was created a life peer after retiring as Chief of the Defence Staff.



**Joe Euteneuer, CFO Mattel**

Prior to joining Rivada's Board, Euteneuer served as Co-CEO and CFO – Americas of Rivada Networks. Previously, he served as Chief Financial Officer of Sprint Corporation from April 2011 until December 2015. Over the course of his nearly 25-year career in telecom and media, Euteneuer has held CFO and EVP positions at Sprint, Qwest Communications (now CenturyLink), XM Satellite Radio, and Comcast. He was appointed Mattel's CFO in September 2017.

# Rivada's Management Team



We have built a strong management team with deep financial and operational experience



**Declan J. Ganley, Founder, Chairman and CEO of Rivada Networks**

Ganley is primarily a telecommunications entrepreneur, having built businesses across Europe, Russia, and the United States. Representing Rivada Networks, Declan received the Louisiana National Guard Distinguished Civilian Service Medal for his work during Hurricane Katrina.



**Francis O'Flaherty, COO**

O'Flaherty is a founding member of the Rivada team and has over 20 years' experience in technology planning and operations. He has been a part of Declan Ganley's management team for more than 14 years. Previously, he worked with Accenture in their High Tech Strategy practice in London.



**Orla Fitzpatrick, CFO**

Orla is a senior finance professional with over 20 years' experience in the telecommunications sector. Previous senior management positions include Senior Finance Director at Nortel Networks from 1998 and Commercial Director EMEA at Ciena from 2010. Orla served on the Board of Directors for a number of Nortel Networks companies. She is a fellow member of the Institute of Chartered Accountants and an associate member of the Institute of Taxation in Ireland.



**Peter Campbell, CIO**

Prior to joining Rivada, Campbell was CIO with Sprint Corp. His management experience includes network engineering, construction, provisioning, maintenance, regulatory matters, labor relations, customer service and finance. He has significant experience in successful vendor management, outsourcing and contract negotiations and IT transformation.



**Karen Freitag, Executive Vice President of Sales**

Freitag is an experienced and accomplished sales executive, having previously served as Vice President of Sales for Ericsson, Vice President of Sales and Operations for Nortel, and most recently as President of Sprint Enterprise, Wholesale and Wireline Solutions.



**Ken Fields, Director of Market Development**

Ken has over 30 years of investment/risk management experience. He began his career on Wall Street managing proprietary capital for Shearson/Lehman Brothers and Bankers Trust, then spent 10 years as an external portfolio manager for Goldman Sachs Alternative Assets.



**Brian Carney, Director of Corporate Communications**

Carney was a member of The Wall Street Journal's editorial board from 2004-2014 and editor of The Wall Street Journal Europe's editorial page from 2004-2005 and 2009-2014. He has won several prestigious awards for his writing on economics and business.



**Bill Esrey, Jr., SVP of Business Development / Wholesale**

Bill brings over 27 years of experience in the telecom industry working for Sprint, Ameritech, and Centel Corporations. He served in Sprint's Global Wholesale organization as vice president of operations, product, marketing and global sales.



**Head of Business Development, Chris Moore**

Chief Moore leads the Rivada business development effort. He retired as the Chief of Police of the San José Police Department after serving for over 30 years as a police officer and after serving in every rank within the Department. In 1999, Chris was selected as a White House Fellow and served one year as Counsel to U.S. Attorney General Janet Reno. He joined Rivada in 2013.



**Peter Cramton, Chief Economist**

Cramton is a Professor of Economics at the University of Maryland and European University Institute. Since 1983, he has conducted widely cited research on auction theory and practice. He has advised numerous governments on market design and has advised dozens of bidders in major auction markets.



**Todd Rowley, SVP of Business Development**

Rowley is leading strategic partnering and new business opportunities for Rivada, Todd has over 30 years of experience in the telecom and cable industries. He was most recently vice president of business development at Sprint, where he spent the past 16 years.



**Stephen Bye, Technology Advisor**

Bye, previously CTO for Sprint, has 24+ years of senior management experience in network strategy, planning, product development and management, network and technology development, network and device engineering, network operations, construction and deployment, field services, systems integration and testing.